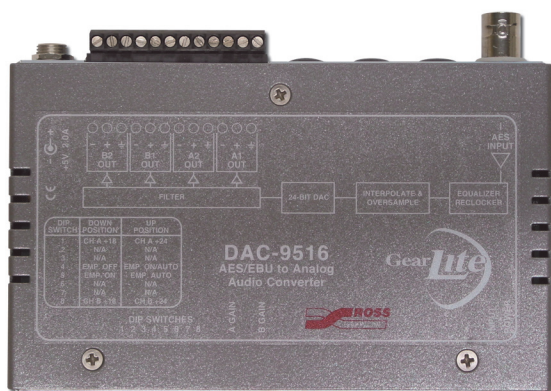




DAC-9516

AES/EBU to Analog Audio Converter

User Manual



Video Production Technology

DAC-9516 User Manual

- Ross Part Number: **9516DR-004-02**
- Release Date: November 7, 2012.

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Important Regulatory and Safety Notices to Service Personnel

Before using this product and any associated equipment, refer to the “**Important Safety Instructions**” listed below to avoid personnel injury and to prevent product damage.

Product may require specific equipment, and/or installation procedures to be carried out to satisfy certain regulatory compliance requirements. Notices have been included in this publication to call attention to these specific requirements.

Symbol Meanings



Protective Earth — This symbol identifies a Protective Earth (PE) terminal, which is provided for connection of the supply system's protective earth (green or green/yellow) conductor.



This symbol on the equipment refers you to important operating and maintenance (servicing) instructions within the Product Manual Documentation. Failure to heed this information may present a major risk of damage or injury to persons or equipment.



Warning — The symbol with the word “**Warning**” within the equipment manual indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Caution — The symbol with the word “**Caution**” within the equipment manual indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



Warning Hazardous Voltages — This symbol is intended to alert the user to the presence of uninsulated “dangerous voltage” within the product enclosure that may be of sufficient magnitude to constitute a risk of shock to persons.



ESD Susceptibility — This symbol is used to alert the user that an electrical or electronic device or assembly is susceptible to damage from an ESD event.

Important Safety Instructions



1. **Warning** – Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. The safe operation of this product requires that a protective earth connection be provided. A grounding conductor in the equipment's supply cord provides this protective earth. To reduce the risk of electrical shock to the operator and service personnel, this ground conductor must be connected to an earthed ground.
6. Do not defeat the safety purpose of the grounding-type plug. A grounding type plug has two blades and a third grounding prong. The third prong is provided for your safety. If the provided plug does not fit in to your outlet, consult an electrician for replacement of the obsolete outlet. Protect the power cord from being walked on or pinching particularly at plugs, convenience receptacles, and point where they exit from the apparatus.



7. **Warning – Indoor Use: WARNING:** To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.
8. Do not block ventilation openings. Install in accordance with manufacturer's instructions.
9. Do not install near heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
10. Do not use this apparatus near water.
11. Only use attachments/accessories specified by the manufacturer.
12. Unplug this apparatus during lightning storms or when unused for long periods of time.
13. Clean only with a dry cloth.
14. To avoid electrical shock, disconnect the A/C power cord before any servicing.
15. Refer all servicing to qualified personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug damage, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

EMC Notices

United States of America **FCC Part 15**

This equipment has been tested and found to comply with the limits for a class A Digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



Notice — *Changes or modifications to this equipment not expressly approved by Ross Video Limited could void the user's authority to operate this equipment.*

CANADA

This Class “A” digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe “A” est conforme à la norme NMB-003 du Canada.

EUROPE

This equipment is in compliance with the essential requirements and other relevant provisions of **CE Directive 93/68/EEC**.

INTERNATIONAL

This equipment has been tested to **CISPR 22:1997** along with amendments **A1:2000** and **A2:2002**, and found to comply with the limits for a Class A Digital device.



Notice — *This is a Class A product. In domestic environments, this product may cause radio interference, in which case the user may have to take adequate measures.*

Maintenance/User Serviceable Parts

Routine maintenance to this GearLite product is not required. This product contains no user serviceable parts. If the module does not appear to be working properly, please contact Technical Support using the numbers listed under the

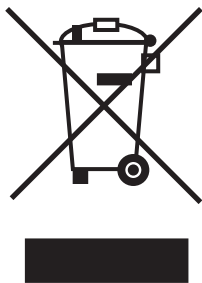
“Contact Us” section on the last page of this manual. All GearLite products are covered by a generous 3-year warranty and will be repaired without charge for materials or labor within this period. See the “Warranty and Repair Policy” section in this manual for details.

Environmental Information

The equipment that you purchased required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

To avoid the potential release of those substances into the environment and to diminish the need for the extraction of natural resources, Ross Video encourages you to use the appropriate take-back systems. These systems will reuse or recycle most of the materials from your end-of-life equipment in an environmentally friendly and health conscious manner.

The crossed-out wheeled bin symbol invites you to use these systems.



If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration.

You can also contact Ross Video for more information on the environmental performances of our products.

Introduction

Overview

The DAC-9516 AES/EBU to Analog Audio Converter is a broadcast quality modular product used to convert 20bit or 24bit AES-3id (coaxial) signals to balanced analog audio. The DAC-9516 accepts one AES audio signal at 32, 44.1, or 48kHz sample rates, and provides two copies of stereo (A, B) balanced analog audio.

The DAC-9516 provides reclocking of the AES stream as well as a state of the art 128X over-sampled Delta Sigma Modulator DAC to convert to analog audio. Following the D-A conversion, the analog audio passes through a very high quality reconstruction filter, which assures low distortion and noise. Two identical copies of the signal are output through a 12-pin screw-type audio terminal block connector. The DAC-9516 provides automatic input cable equalization for lengths up to and beyond 610m (2000ft).

The front panel of the DAC-9516 chassis provides the operational controls. Coarse level adjustment headroom switches (18dB or 24dB), and a fine gain adjustment potentiometer (+/-6dB) for each channel, are provided to enable precise matching to your facility's house reference audio level. The DAC-9516 can accommodate any full-scale digital (FSD) level in the -12 to -30dBFS range. Automatic detection of AES/EBU 50/15 s de-emphasis is available for all data rates. In addition, user-selectable settings are available for Emphasis controls. Status indicator LEDs provide visual references for the input signal and power supplied to the module.

The DAC-9516 includes a universal power adaptor and line cord suitable for the country of use. Various mounting options are included that enable a wide range of installation choices. The DAC-9516 provides a flexible high quality AES/EBU conversion solution in a compact, stand-alone package. Designed and manufactured to meet the highest quality broadcast industry standards, the DAC-9516 is an ideal, cost effective solution for AES/EBU to analog audio conversion.

Simplified Block Diagram

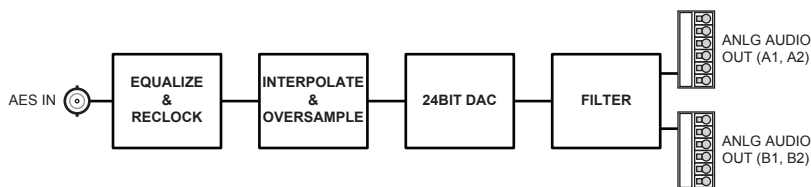


Figure 1 Simplified Block Diagram of DAC-9516 Functions

Features

The DAC-9516 includes the following features:

- Supports data rates in the 28kHz to 50kHz range including 32kHz, 44.1kHz, and 48kHz
- 24bit DAC resolution
- Reclocking to reduce jitter and noise
- Conformity to AES-3id 1995 and SMPTE 276M
- Adjustable headroom level
- Input range from 100mV to 2.5V p-p
- Two stereo audio output copies
- Terminating input 75ohms
- Automatic input cable equalization for > 610m (> 2000ft) of Belden 8281
- Visual indicator LEDs for signal presence and power status
- Small brick form factor
- 5V universal adapter with locking DC connector
- 3-year warranty

Installation

Static Discharge

Whenever handling the DAC-9516 and other related equipment, please observe all static discharge precautions as described in the following note:



ESD Susceptibility — *Static discharge can cause serious damage to sensitive semiconductor devices. Avoid handling circuit boards in high static environments, such as carpeted areas, and when wearing synthetic fiber clothing. Always exercise proper grounding precautions when working on circuit boards and related equipment.*

Unpacking

Unpack each DAC-9516 module you received from the shipping container and check the contents to ensure that all items are included. If any items are missing or damaged, contact your sales representative or Ross Video directly.

Mounting and Installation

The DAC-9516 can be mounted in any convenient location. However, to ensure long life for this product, observe the following precautions and operating requirements:

- Maintain an ambient temperature of 20°C to 40°C.
- Allow for air circulation around the chassis for convectional cooling.

Many different mounting positions are possible with the included mounting hardware. Some installation options are permanent and require careful consideration of the final positioning before installation. Please note that in some mounting locations, the power adaptor must be affixed in a similar manner as the chassis.

Other possible options include the use of adhesive magnetic sheets (not included) affixed to the chassis and the power adaptor, for removable mounting on metal cabinets etc.

Cable ties may be necessary in some applications to relieve strain on the mounting hardware and the connectors.

Surface Mount Strips

The included VELCRO® brand surface mount strips allow the GearLite module and power supply to be affixed to a permanent location during use and easily

removed for adjustments. Carefully consider the installation location before proceeding; the adhesive is very aggressive and is not easily removed. The adhesive will cure fully in 24 hours.

To install the Surface Mount Strips

1. Remove the **Protective Backing Film** from the adhesive on the bottom of the two VELCRO® brand **Surface Mount Strips**.
2. Adhere the **Surface Mount Strips** to the bottom side of the chassis. (**Figure 2**)

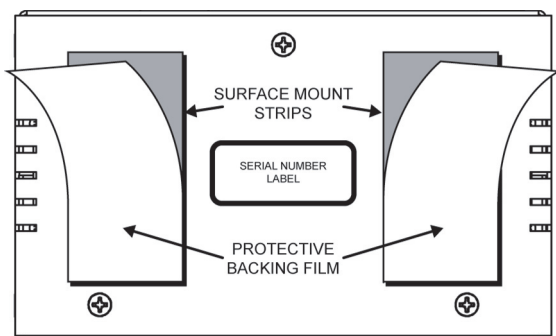


Figure 2 Surface Mount Installation Option

3. Remove the **Protective Backing Film** from the other side of the VELCRO® brand **Surface Mount Strips**.
4. Press the chassis into position on the surface you want to mount it to.



Operating Tip — An additional VELCRO® brand **Surface Mount Strip** is available to mount the power adapter.

Non-Slip Pads

Four non-slip adhesive pads have been supplied for desktop placements. Simply remove the protective backing film from the adhesive and affix one non-slip pad to each of the four corners on the bottom of the chassis.

Optional Mounting Accessories

Ross Video is committed to providing practical solutions for the needs of your high-quality broadcast facility.

Flat Metal Plate

Use the flat metal plate for permanent mounting to a rack, a desk, or any other location where bolts or screws can be applied. Be sure to position the module to allow for operator adjustments, if required.

To install the Flat Metal Plate

1. Remove the **2** screws from the bottom of the chassis.
2. Install the **Flat Metal Plate** onto the bottom of the chassis (**Figure 3**) using the screws provided in the Mounting Kit. Do not use the screws removed during **Step 1**.

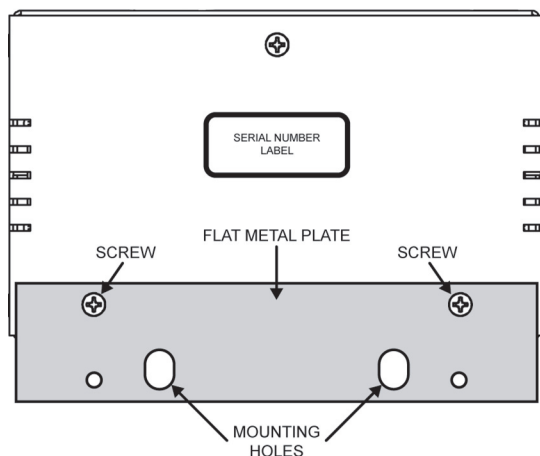


Figure 3 Flat Metal Plate Installation Option

3. Install the chassis in the desired location using the **Mounting Holes** on the **Flat Metal Plate**. Mounting screws are not provided by Ross Video.

Angle Mounting Bracket

The Angle Mounting Bracket (**Figure 4**) allows a single GearLite module to be installed in positions not possible with the flat metal plate. The bracket has a 90° angle. Mounting screws are not provided by Ross Video.

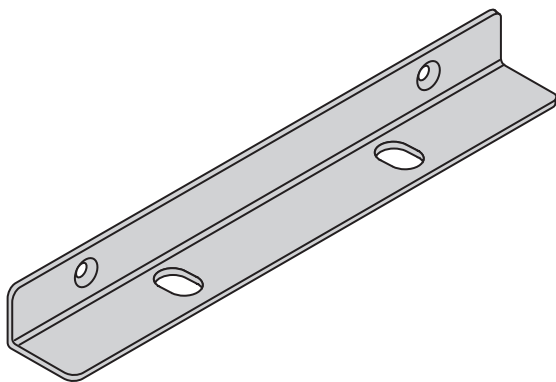


Figure 4 *Angle Mounting Bracket*

Setup

Power Adapter and Supply

Connect the PS-9000 power adaptor to the power supply connector. The PS-9000 provides up to 2A of regulated +5V DC (5%). The DC power cord has a locking connector that securely fastens into the power supply DC jack on the DAC-9516. The DAC-9516 has a standard miniature power jack (center pin positive).

If using an adaptor other than the PS-9000, ensure that:

- the polarity is correct
- the voltage is +5V DC regulated to 5%
- sufficient current for the DAC-9516 is supplied



Caution — *Use of improper adaptors may damage the DAC-9516 and will void the warranty.*

Installations outside of North America using line voltages of 200-240V require a plug, certified for the country of use, to be installed on the supplied line cord. Refer to the section “**Important Regulatory and Safety Notices to Service Personnel**” at the front of this manual for details.

Cable Connections Overview

Connect the cables to the DAC-9516 according to the designations indicated on the chassis label and **Figure 5**. The input is internally terminated at 75ohm. It is not necessary to terminate unused outputs.

The DAC-9516 provides the following connections:

- 1 AES input (BNC)
- 2 balanced analog audio outputs (positive, negative, and ground terminals for each channel) on a 12-pin terminal block
- 1 power supply input

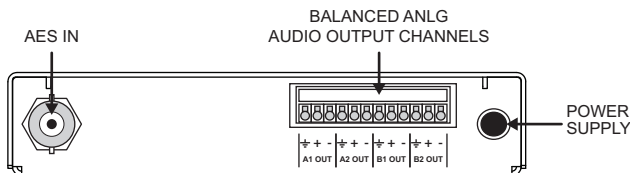


Figure 5 DAC-9516 Connections

I/O Connectors

Table 1 indicates the pin numbering and function of the analog connectors. Note the pin designations are also shown on the label of the DAC-9516.

Table 1 DAC-9516 Output Analog Connectors

Outputs	
Pin	Signal
1	B2-
2	B2+
3	GND
4	B1-
5	B1+
6	GND
7	A2-
8	A2+
9	GND
10	A1-
11	A1+
12	GND

AES Input Cable Connection

Connect the AES/EBU input cable to the DAC-9516 according to the designation indicated on the chassis label. The input is internally terminated at 75ohms.

The DAC-9516 can accommodate any full-scale digital (FSD) level in the -12dBFS to -30dBFS range. It should be noted that although the DAC-9516 may be configured with -30dBFS headroom, a maximum analog audio output of the card (+27dBu) should be observed to prevent clipping of the signal.

Analog Audio Output Connections

On the rear edge of the DAC-9516 there is a removable 12-pin audio terminal block which has slots for the positive, negative, and grounded wires of two pairs of balanced analog audio cables.

To wire the cables to the connector:

1. Gently pull the block from the unit.
2. Following the diagram on the top of the chassis, insert an analog audio wire into the designated polarity slot on the block.

- 3. Use a tweaker screwdriver to tighten the slot's connector clamp on the block.
- 4. Repeat steps 2 and 3 for each wire on each input.
- 5. Once the cables have been wired to the block, insert the block back onto the unit so that the slotted tongues fit in the grooved side on the block socket.

DIP Switch Setup

The top of the DAC-9516 chassis includes a label that provides a condensed DIP switch settings chart. This chart is intended as a quick reference guide. Refer to for DIP Switch locations.

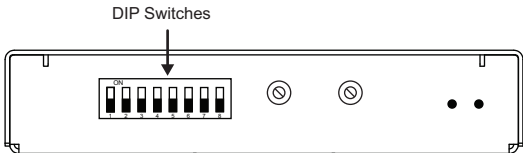


Figure 6 DAC-9516 — DIP Switch Locations

Table 2 outlines how to set **SW1-8** and the following conventions are used:

- ↑ Set the DIP switch in the UP position
- ↓ Set the DIP Switch in the DOWN position (near the number)

Table 2 DIP Switch Positions

DIP Switch	Position	Function
1	↑	Channel A headroom adjust +24dBu
	↓	Channel A headroom adjust +18dBu
2	Not implemented	
3	Not implemented	
4	↑	Emphasis On/Auto
	↓	Emphasis Off
5	↑	Emphasis Auto
	↓	Emphasis On
6	Not implemented	

Table 2 DIP Switch Positions

DIP Switch	Position	Function
7	Not implemented	
8	↑	Channel B headroom adjust +24dBu
	↓	Channel B headroom adjust +18dBu

Headroom Select

There are two copies of the analog stereo signal output from the 12-pin connector. Each output consists of an A and B channel (Left and Right).

To adjust the output level

1. Select the approximate FSD level (18dB or 24dB) using the headroom DIP switches (A Level and B Level).
2. Turn the potentiometers (A GAIN and B GAIN) to trim the FSD level ($\pm 6\text{dB}$) to your installation's standard.
 - 24dB or 18dB Switch selectable for AES A and AES B
 - $\pm 6\text{dB}$ continuous adjustment for AES A and AES B

De-Emphasis Select

Set the Emphasis DIP switches (**SW4**, **SW5**) as described in **Table 3**, based on your requirements.

Table 3 Emphasis Selection — SW4, SW5

SW4	SW5	Emphasis
↑	↑	<ul style="list-style-type: none">• Auto• 50/15μs de-emphasis curve applied according to: the current sampling rate, and the AES Professional Channel Status Bits
↑	↓	<ul style="list-style-type: none">• On• Forced de-emphasis according to current sampling rate
↓	↑ or ↓	<ul style="list-style-type: none">• Off• No de-emphasis filtering

Potentiometers

There are two copies of the analog stereo signal output from the 12-pin connector. Each output consists of an A and B channel (Left and Right).

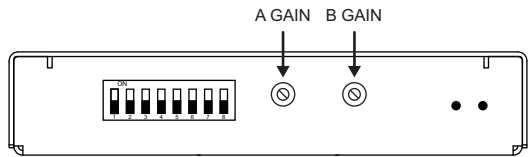


Figure 7 DAC-9516 — Potentiometer Locations

To adjust the output level

- 1. Select the approximate FSD level (18dB or 24dB) using the headroom DIP switches (A Level and B Level).
- 2. Turn the potentiometers (A Gain and B Gain) to trim the FSD level (± 6 dB) to your installation’s standard. Refer to Table 4.

Table 4 Emphasis Selection — SW4, SW5

Potentiometer	Label	Function
RV1	A Gain	Use to set fine level adjustment for Channel A
RV2	B Gain	Use to set fine level adjustment for Channel B

Audio Levels

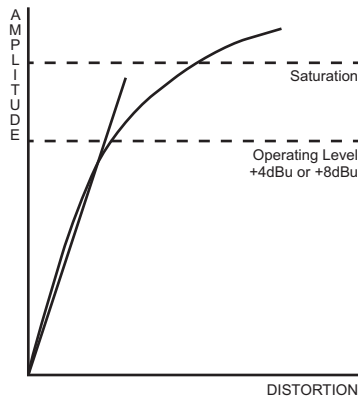


Figure 8 Analog Audio

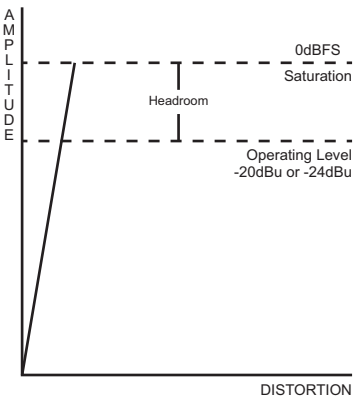


Figure 9 Digital Audio

The preceding graphs of amplitude vs. distortion for analog and digital audio equipment show that digital audio does not gradually degrade (become more distorted) as the amplitude increases. Likewise, the digital audio signal does not

exist above 0dBFS. For these reasons, the interface between existing analog house reference standards and digital audio standards are as shown in **Table 5**.

Table 5 Analog House Reference and Digital Audio Interface

Reference	Headroom	Max. Input	Application
0dBu	14dB	+14dBu	AES/EBU for Audio Production
+4dBu	20dB	+24dBu	AES/EBU for Audio Production
+8dBu	18dB	+26dBu	AES/EBU for 525 Video
+4dBu	18dB	+22dBu	AES/EBU for 625 Video
+4dBu	22dB	+26dBu	AES/EBU for 625 Video

The coarse input level headroom adjustment is made with the 'A Level' and 'B Level' switches. These switches put the available headroom of the D/A Converter in the +18dBFS or +24dBFS range.

The fine input level, headroom adjustment is made using the 'A Gain' (RV1) and 'B Gain' (RV2) potentiometers. These pots provide $\pm 6\text{dB}$ adjustment on the +18dBFS and +24dBFS switch settings. Using these adjustments, the total headroom is adjustable over the -12dBFS to -30dBFS range.

This means that for a -20dBFS input, the analog outputs may be set to -8dBu to +10dBu. Likewise, for a -18dBFS input, the output may be set anywhere in the range of -6dBu to +12dBu. Keep in mind that the maximum output level (1% THD+N) is 27dBu (@ 1kHz).

Status and Selection LEDs

The front edge of the DAC-9516 has two LED indicators.

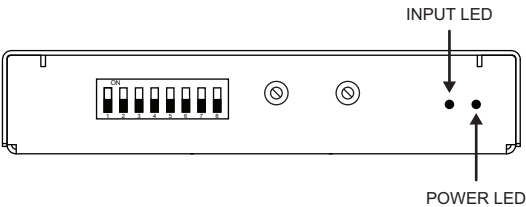


Figure 10 DAC-9516 — LEDs

Table 6 Status LED Descriptions

LED	Color	Function
INPUT	Green	When lit, this LED indicates that the AES input is present and valid.
POWER	Green	When lit, this LED indicates that the DAC-9516 is powered on.

Specifications

Specifications are subject to change without notification.

Table 7 DAC-9516 — Technical Specifications

Category	Parameter	Specification
AES/EBU Input	Number of Inputs	1 AES-3id
	Standards Supported	SMPTE 276M
	Sampling Rates	32kHz, 44.1kHz, 48kHz
	Input Impedance	75ohm terminating
	Input Return Loss	<-38dB (0.1 to 6MHz)
	Input Level	Minimum: 100mV
		Maximum: 2.5Vp-p
	Connector	BNC
Analog Audio Outputs	Number of Outputs	2 balanced stereo pair copies (A1 and B1, A2 and B2) via removable terminal block strips
	Connectors	12-pin screw-type terminal block strip
	Output Impedance	66ohm
	Maximum Output Level	+27dBu into 10kohm
Performance	Quantization	8 to 24bits
	Frequency Response	20Hz - 20kHz ± 0.2 dB @ Fs=48kHz
	Signal to Noise Ratio	>100dB (22Hz-20kHz AES 17 filter) 48kHz - 20dBFS
	THD	<0.01% >100dB @ -20dBFS
	IMD	<0.002% SMPTE/4:1
	Nominal Analog Output Levels	-8dBu to +10dBu for -20dBFS
	Crosstalk	<-98dB to 20kHz

Table 7 DAC-9516 — Technical Specifications

Category	Parameter	Specification
Performance	Audio Delay	0.7ms (AES In to Analog Audio Out)
Power	Required Voltage	+5V DC (5% regulation)
	Power Consumption	<3.4W typical
Other	Thermal Environment	20°C to 40°C (68°F to 104°F), ambient, non-condensing
	Dimensions	13cm x 9cm x 2.5cm (5" x 3.5" x 1")
	Weight	312g (11oz)

Service Information

Warranty and Repair Policy

The GearLite DAC-9516 is warranted to be free of any defect with respect to performance, quality, reliability, and workmanship for a period of THREE (3) years from the date of delivery to the customer. In the event that your GearLite DAC-9516 proves to be defective in any way during this warranty period, Ross Video Limited reserves the right to repair or replace this piece of equipment with a unit of equal or superior performance characteristics.

Should you find that this GearLite DAC-9516 has failed after your warranty period has expired, we will repair your defective product should suitable replacement components be available. You, the owner, will bear any labor and/or part costs incurred in the repair or refurbishment of said equipment beyond the THREE (3) year warranty period.

In no event shall Ross Video Limited be liable for direct, indirect, special, incidental, or consequential damages (including loss of profits) incurred by the use of this product. Implied warranties are expressly limited to the duration of this warranty.

This DAC-9516 User Manual of our Digital Products line provides all pertinent information for the safe installation and operation of your GearLite Product. Ross Video policy dictates that all repairs to the GearLite DAC-9516 are to be conducted only by an authorized Ross Video Limited factory representative. Therefore, any unauthorized attempt to repair this product, by anyone other than an authorized Ross Video Limited factory representative, will automatically void the warranty. Please contact Ross Video Technical Support for more information.

In Case of Problems

Should any problem arise with your GearLite DAC-9516, please contact the Ross Video Technical Support Department. (Contact information is supplied at the end of this publication.)

A Return Material Authorization number (RMA) will be issued to you, as well as specific shipping instructions, should you wish our factory to repair your GearLite DAC-9516. If required, a temporary replacement module will be made available at a nominal charge. Any shipping costs incurred will be the responsibility of you, the customer. All products shipped to you from Ross Video Limited will be shipped collect.

The Ross Video Technical Support Department will continue to provide advice on any product manufactured by Ross Video Limited, beyond the warranty period without charge, for the life of the equipment.

Notes:

Notes:



Contact Us

Contact our friendly and professional support representatives for the following:

- Name and address of your local dealer
- Product information and pricing
- Technical support
- Upcoming trade show information

Technical Support

Telephone: +1 613 • 652 • 4886
After Hours Emergency: +1 613 • 349 • 0006
Email: techsupport@rossvideo.com

General Information

Telephone: +1 613 • 652 • 4886
Fax: +1 613 • 652 • 4425
Email: solutions@rossvideo.com
Website: <http://www.rossvideo.com>

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